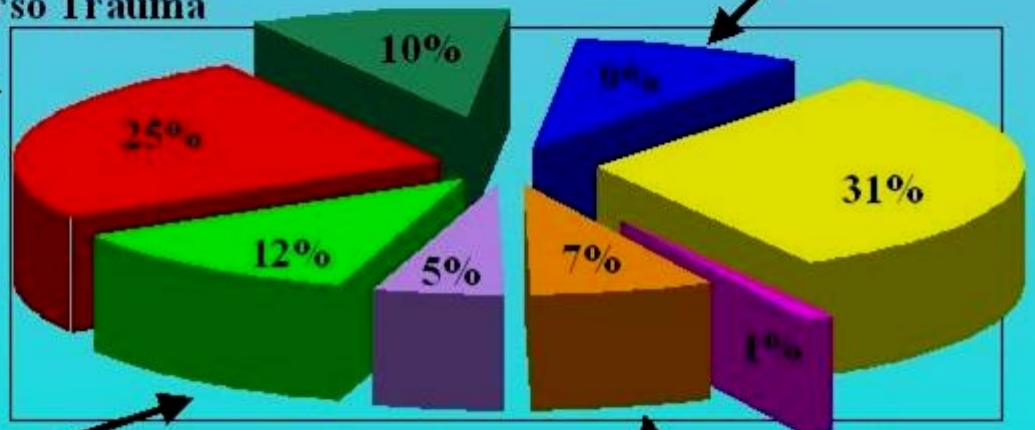
War Wounds

Chapter 1: Weapons Effects/Parachute Injuries
Chapter 29: Environmental Injuries
Chapter 30: Radiological Injuries
Chapter 31: Biological Warfare
Chapter 32: Chemical Injuries

Learning Objectives

- Define the spectrum of combat injuries
- Describe the injury mechanisms related to explosions
- Delineate the fundamental principles of combat wound management

Vietnam Fatality Rates



10% KIA- Surgically Correctable Torso Injury

9% KIA- Exanguination From Extremity Wounds

25% KIA- Surgically Uncorrectable Torso Trauma

31% KIA- CNS Injury

12% DOW- Largely Infections & Complications Of Shock

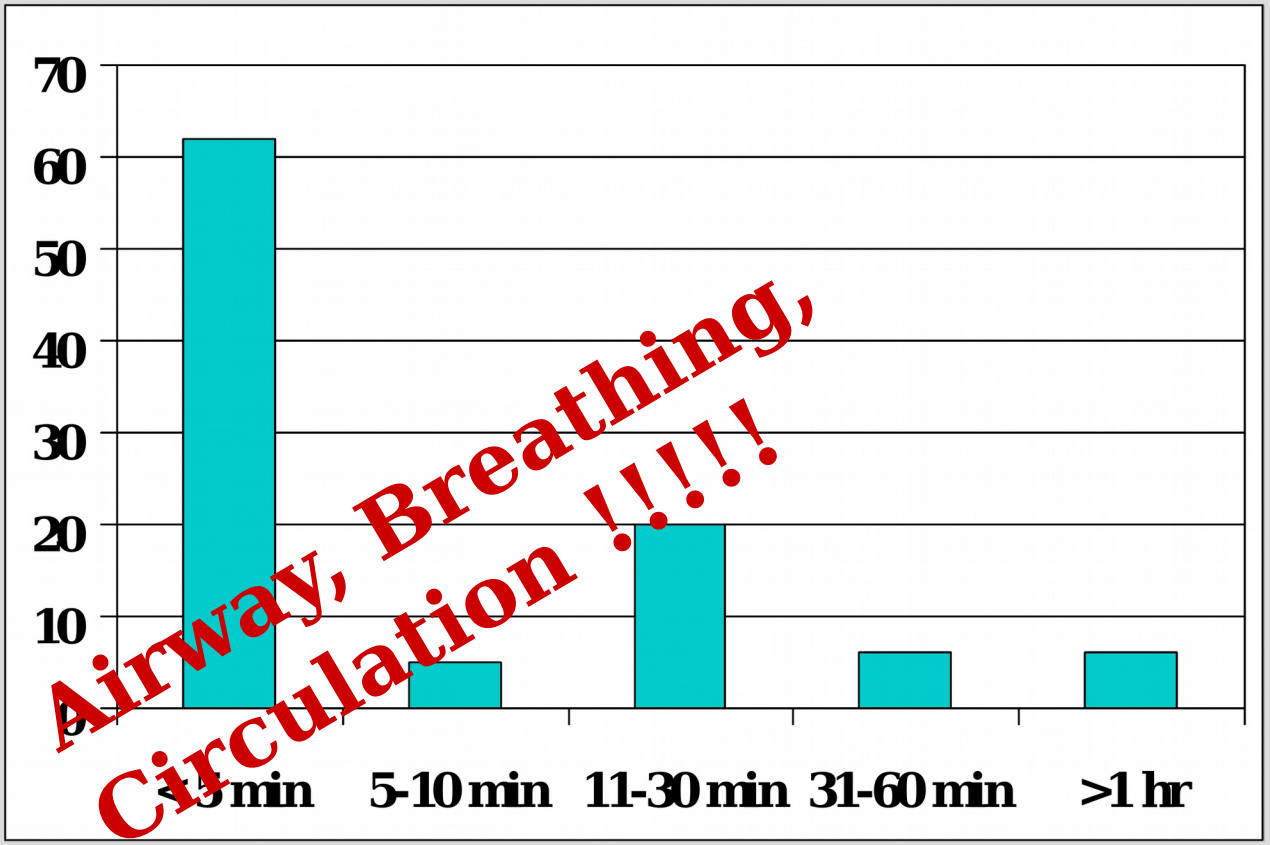
5% KIA- Tension Pneumothorax

7% KIA- Blast/Mutilating Trauma

1% KIA- Airway Obstruction

Col Ron Bellamy

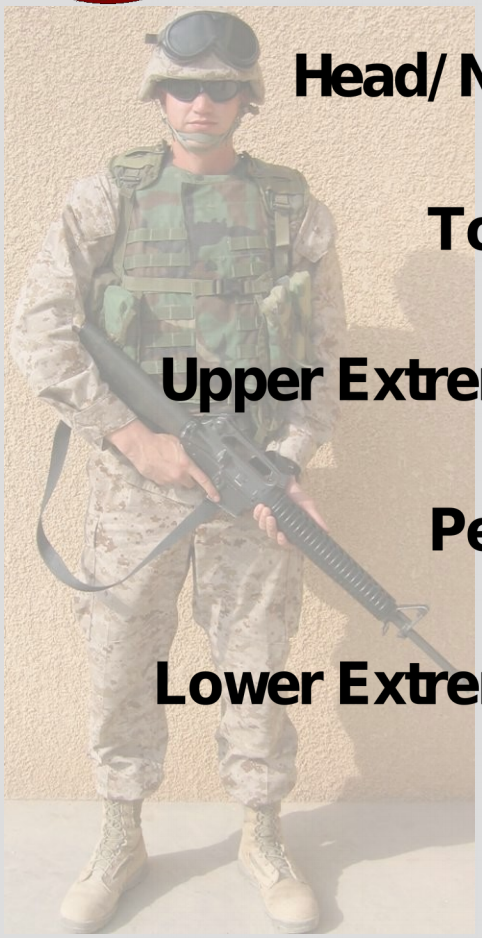
Military Fatality Rates

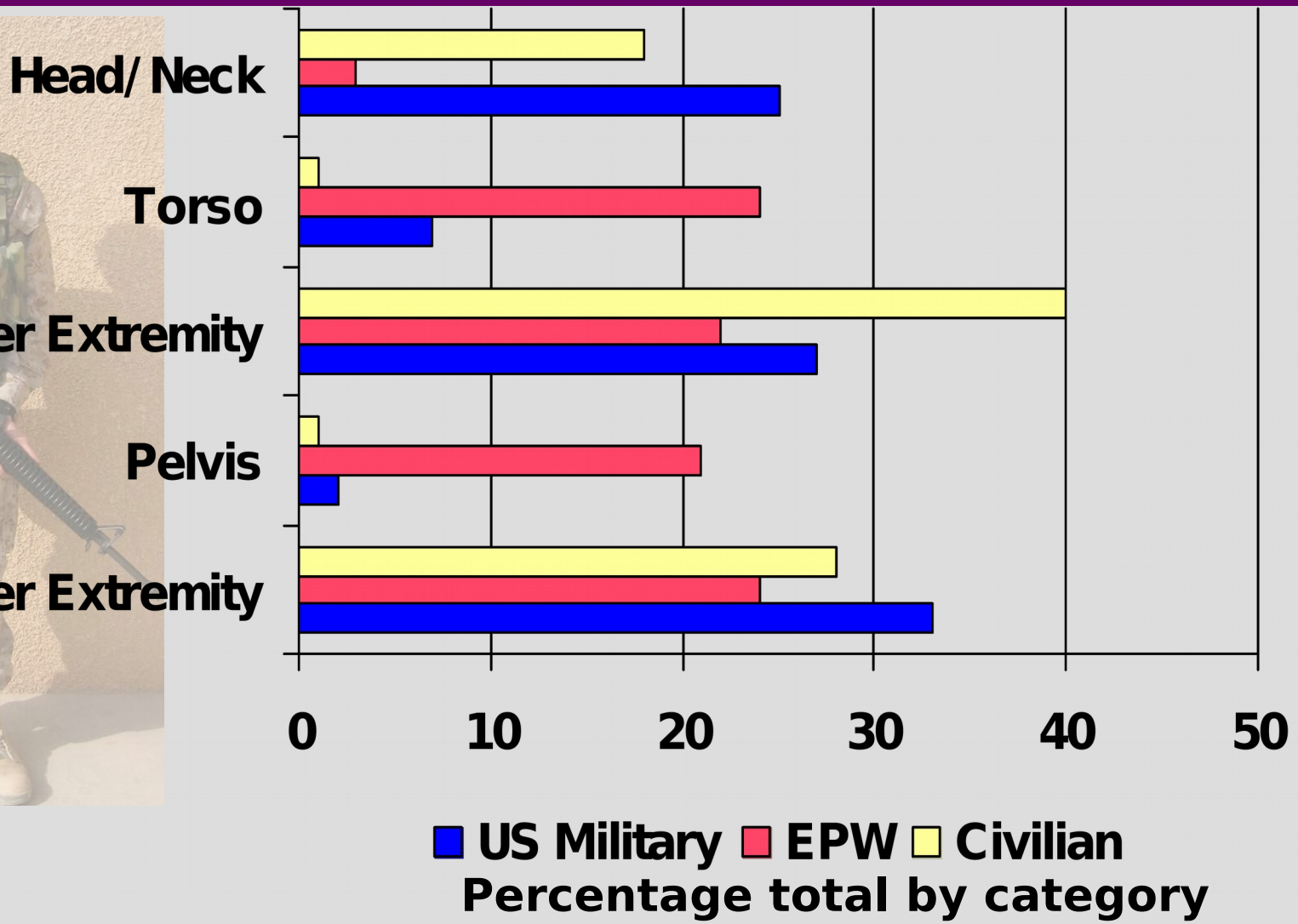


Estimated Time, Wounding to Death

(Zajtchuk, et al, Military Medicine, 1995)

Battlefield Distribution of Wounds





Ref: Patel et al, J Trauma, Aug 2004, Vol 57, p201

Goals of Combat Surgery

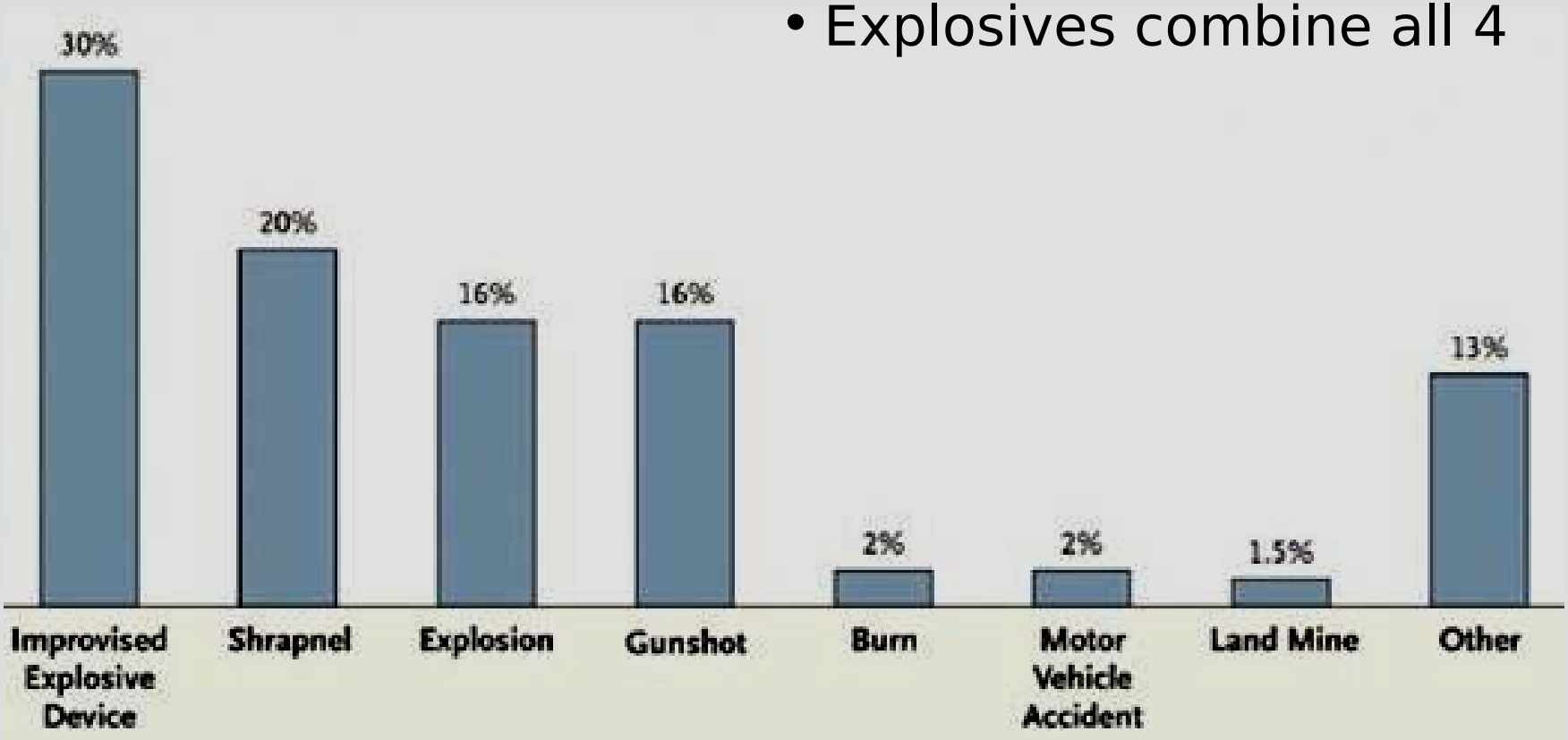
- Return greatest number to combat
- Save life
- Save limb
- Save eyesight

Principles of Combat Surgery

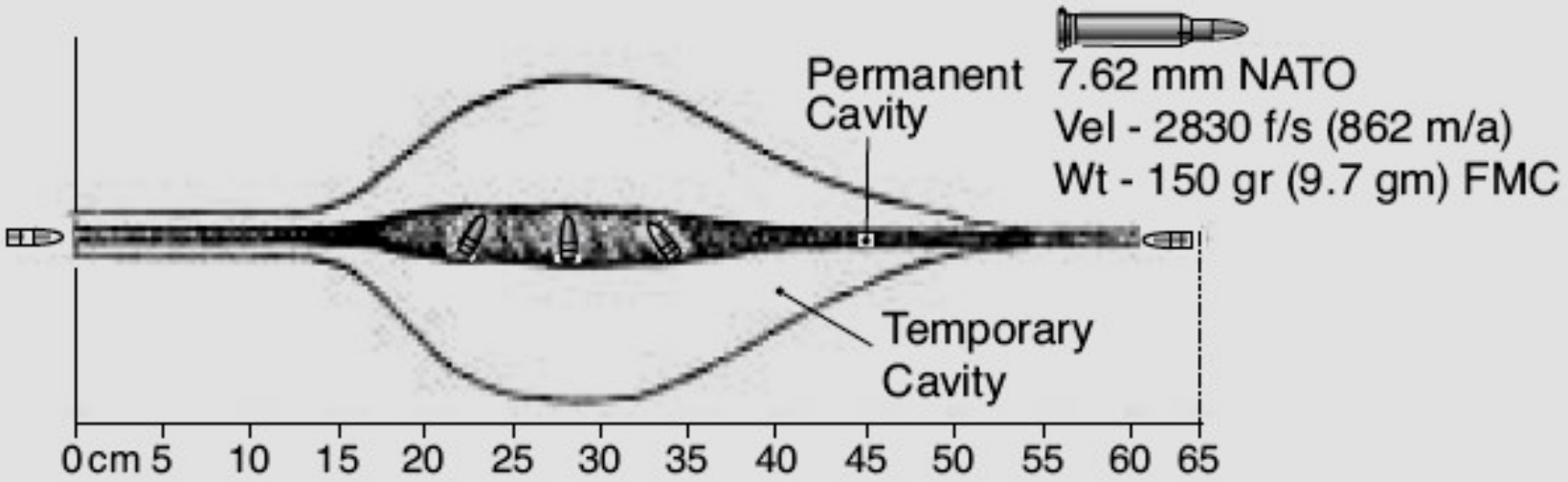
- Establish priorities of care
- Treat the wound not the weapon
- Prevent infectious complications
- Minimize residual disability

Battle Injuries - Mechanisms

- Penetrating
- Blunt
- Environmental
- Blast
  - Explosives combine all 4



High Velocity GSW

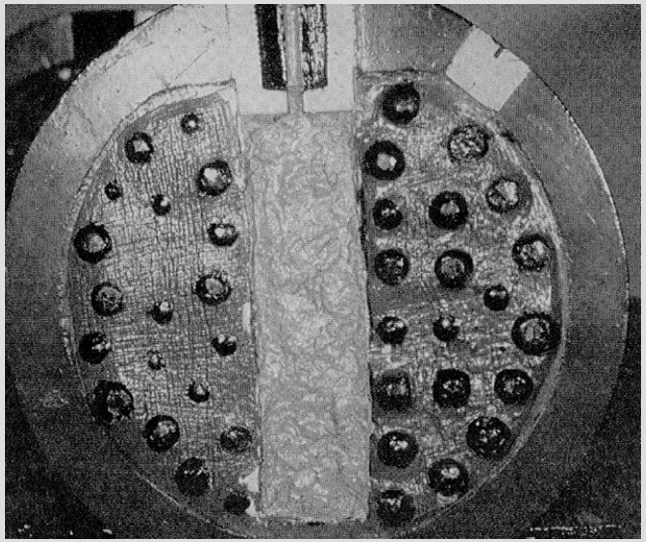


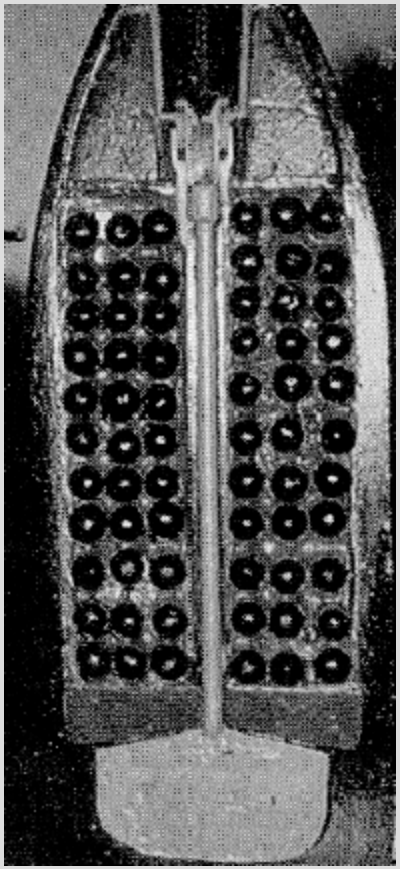
Emergency War Surgery, 3rd Edition

Fragments

- Derived from explosive munitions
  - IEDs
  - Grenades
  - Homicide bombers
  - Car bombers
- Variable
  - Size
  - Shape
  - Composition

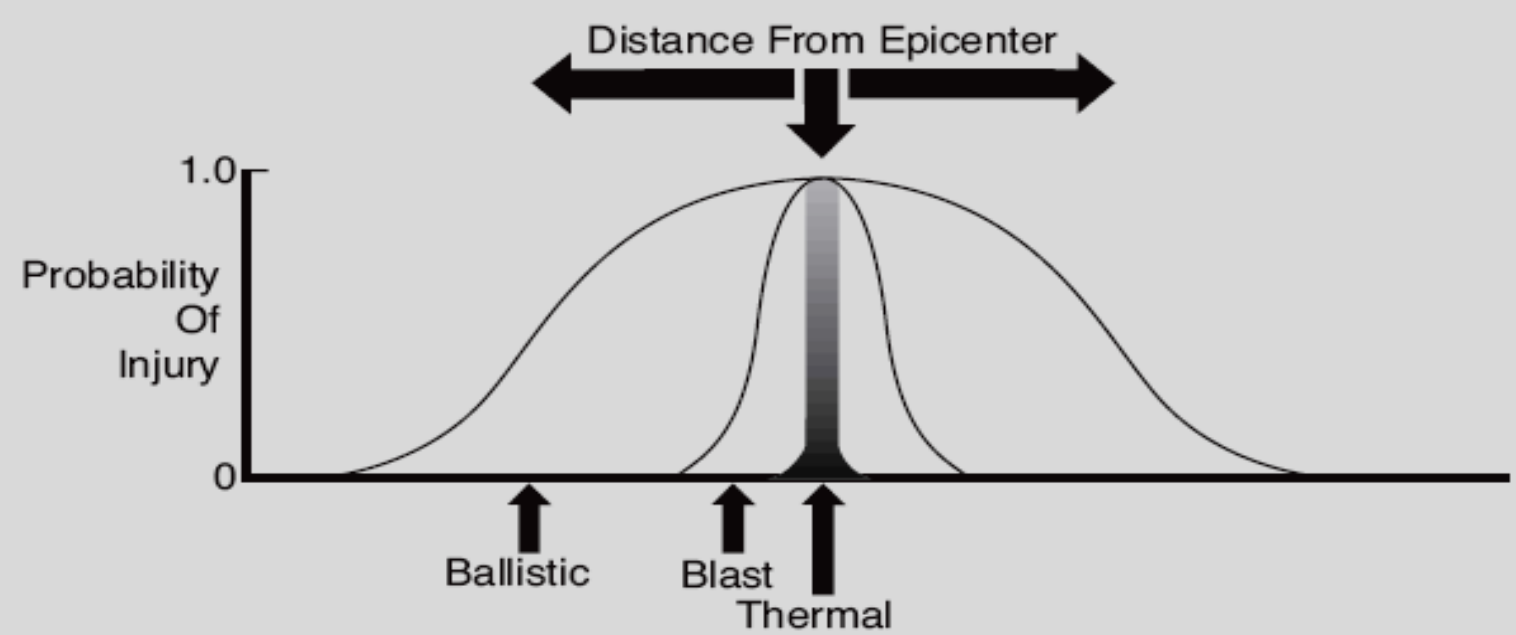
Fragment ≠ Shrapnel





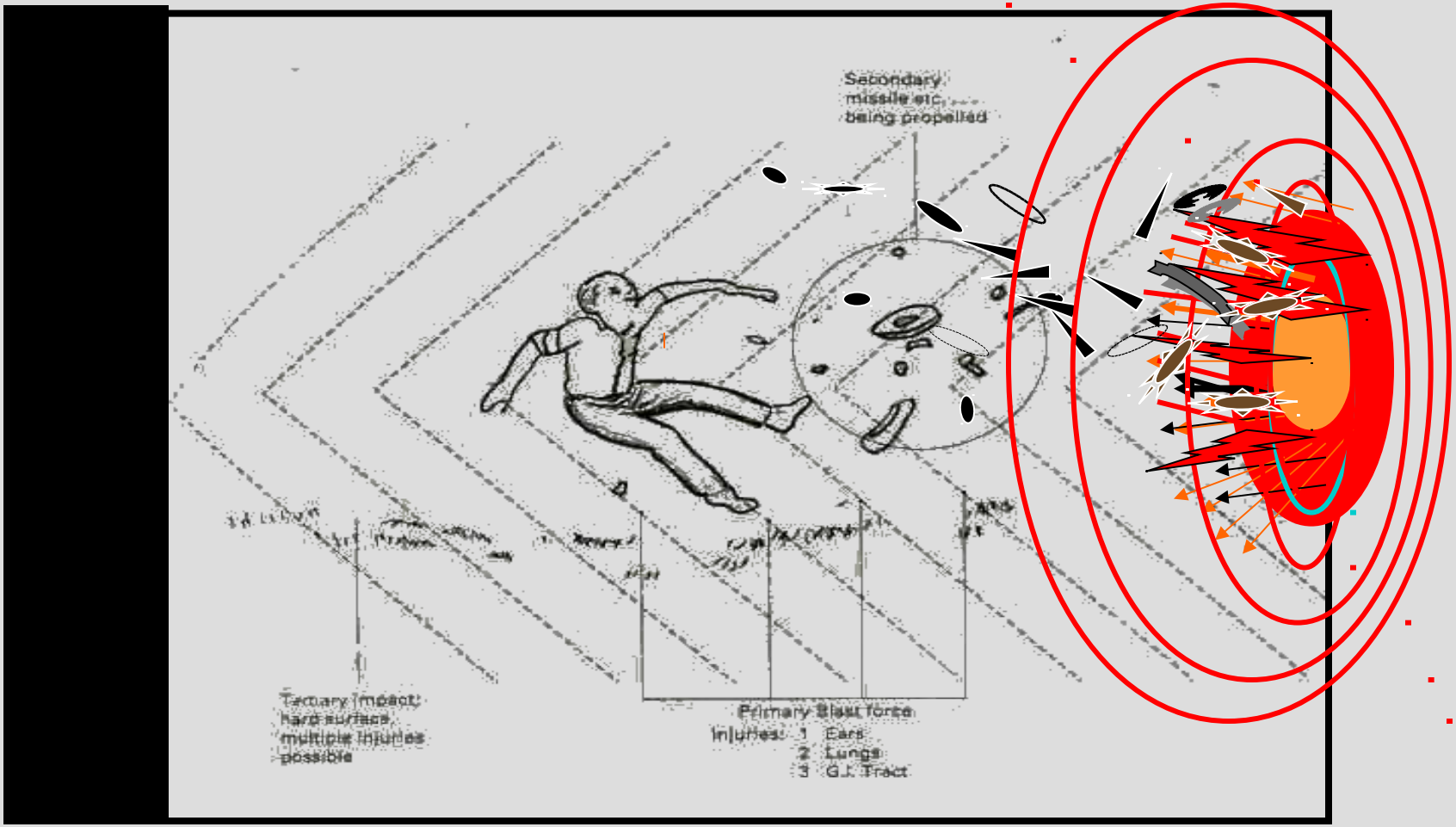
Shrapnel last used in World War I

Explosive Mechanisms



Emergency War Surgery, 3rd Edition

Blast Wave (Primary)

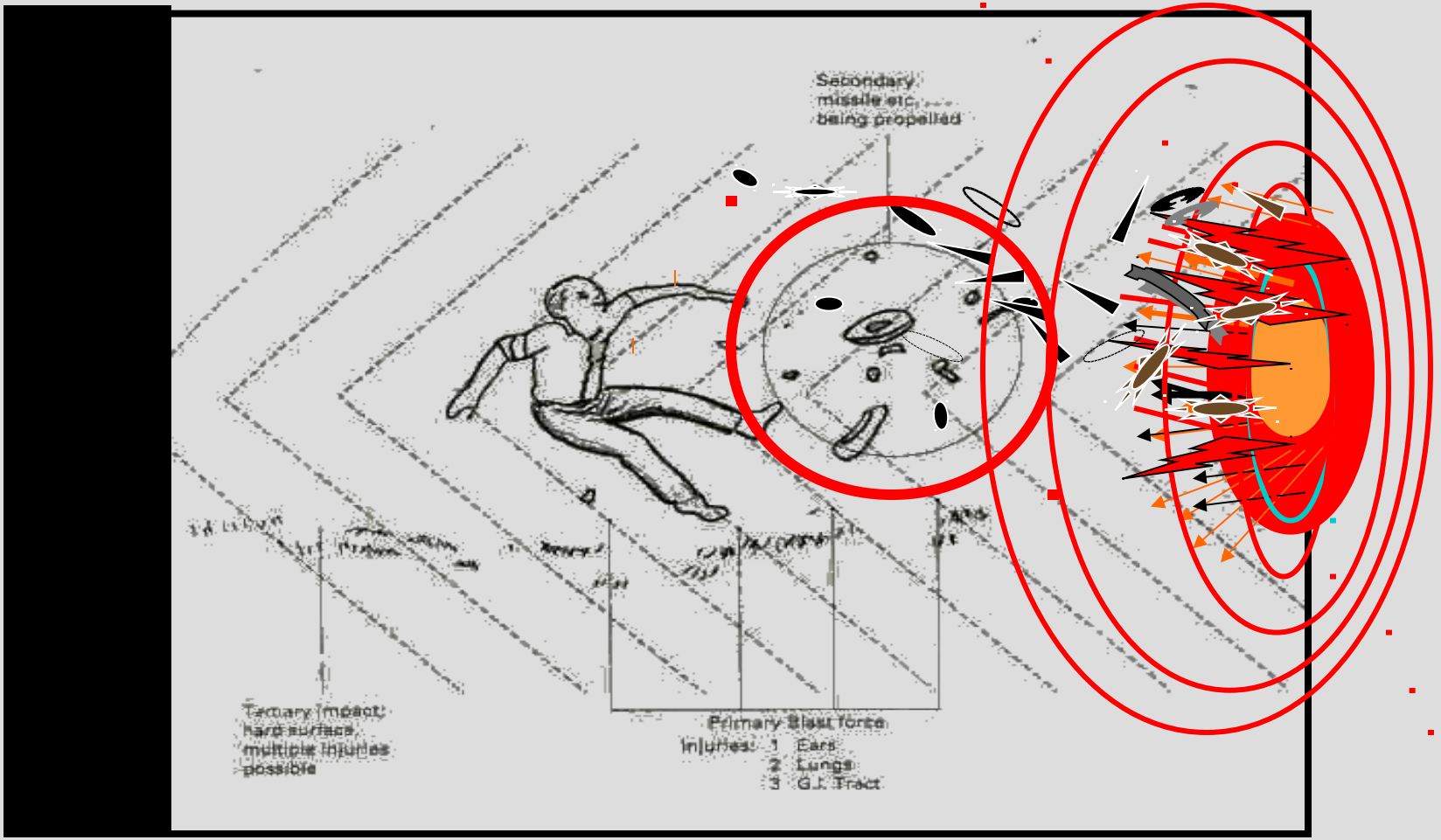


Primary

- Blast pressure wave
  - Total lung barotrauma (blast lung)
  - Tympanic membrane rupture
  - Bowel perforation
  - Severe cerebral contusions

Responsible for death

Penetrating (Secondary)

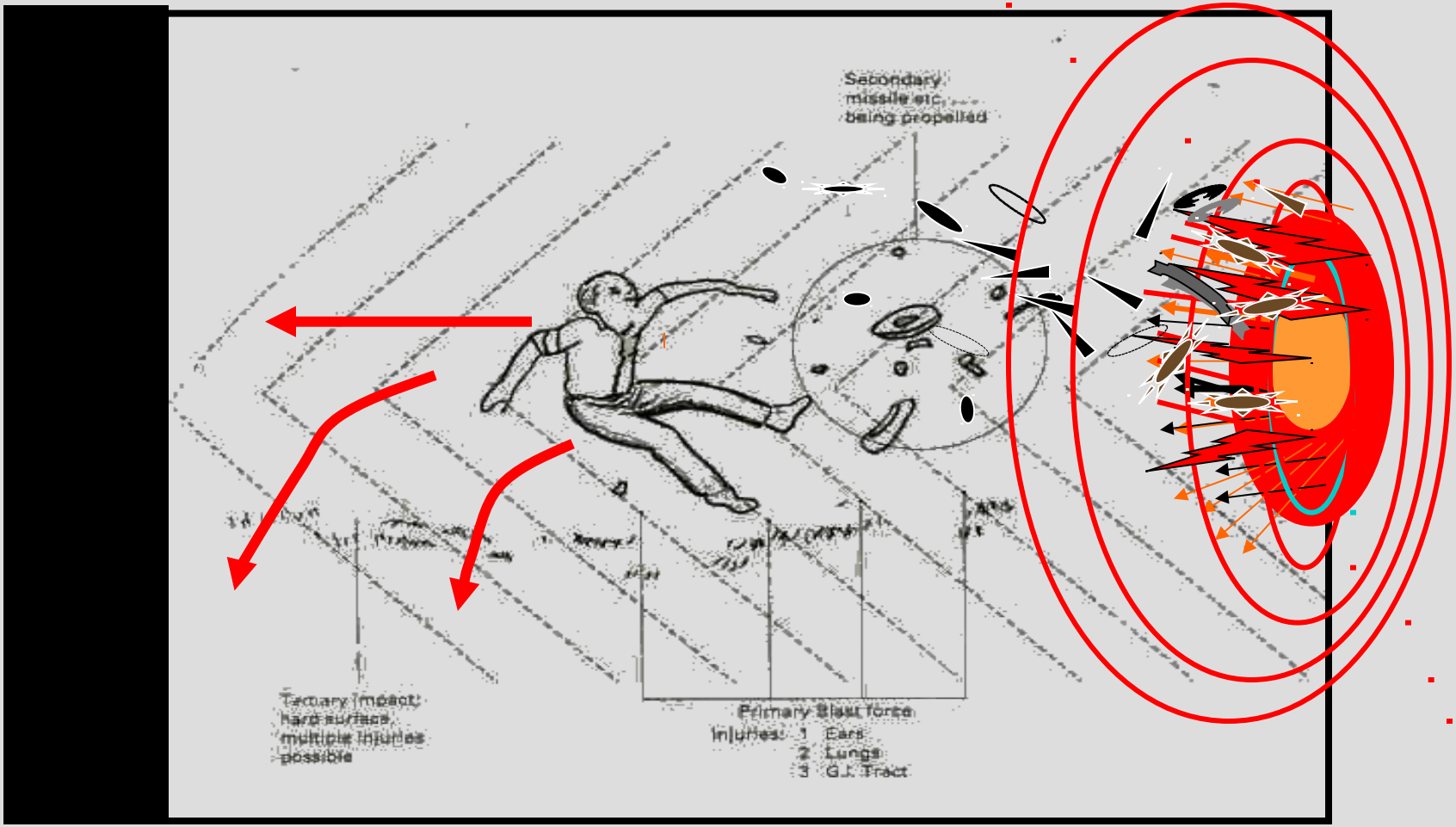


Secondary

- Penetrating (fragments and debris)
  - Unprotected torso
  - Extremity
  - Eye
  - Head/neck

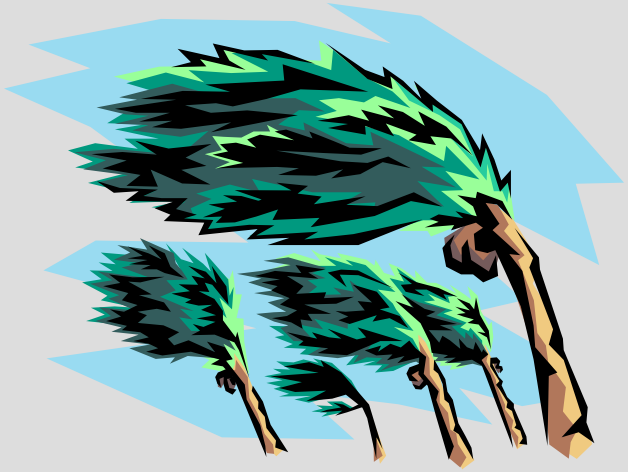
Responsible for wounding

Blunt (Tertiary Blast Wind)

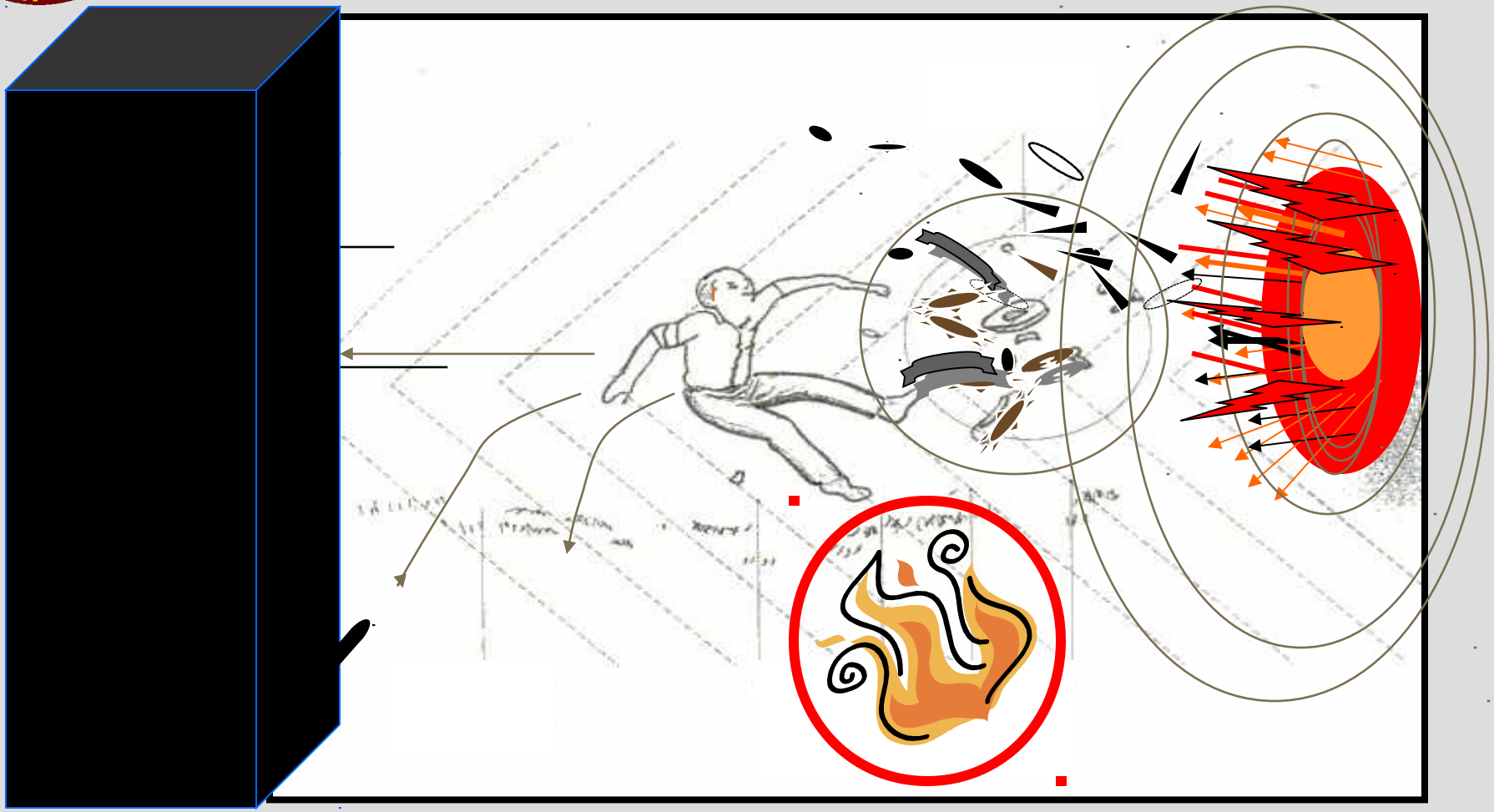

Secondary missile etc. being propelled
Tertiary Impact: hard surface, multiple injuries possible
Primary Blast force injuries: 1 Ears 2 Lungs 3 G.I. Tract

Tertiary

- Blunt (blast wind)
  - Falls
  - Crush



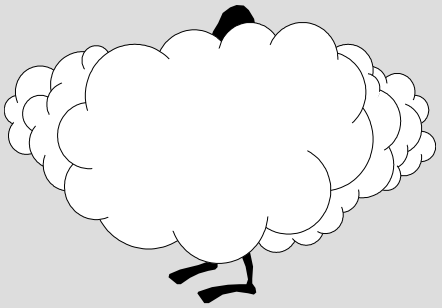
Thermal (Quaternary)



Quaternary

- All other injuries/illnesses
  - Thermal

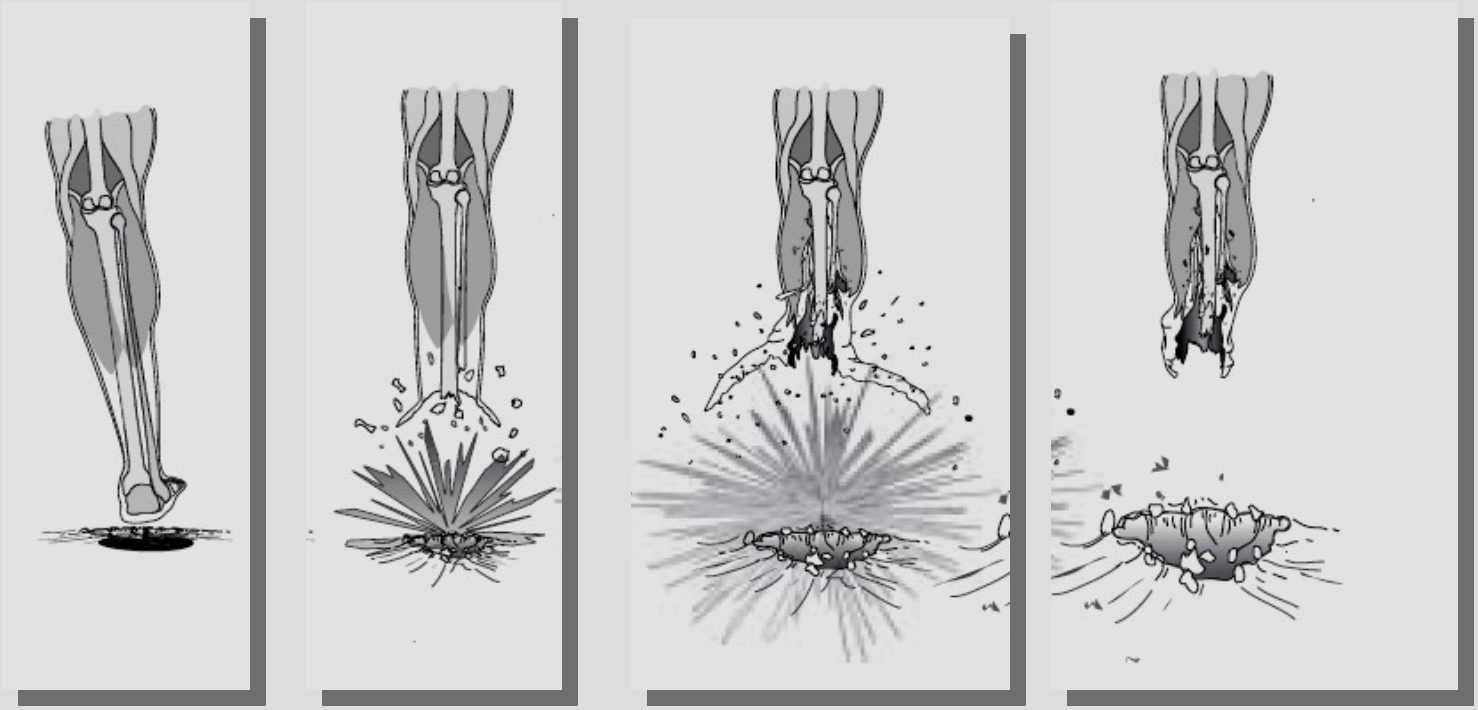
  - Exacerbations of preexisting conditions



Casualties from Explosions

- Type of explosive (high vs. low order)
- Environment (confined vs. open)
- Nature of deliver
- Radius from blast
- Intervening protection

Landmine Injury



Nothing is what it seems, so . . .

Emergency War Surgery, 3rd Edition

War Wounds of Limbs, ICRC

New Wounds?

Iraq

Viet Nam

Courtesy COL David Burris, USUHS

New Wounds?

Viet Nam

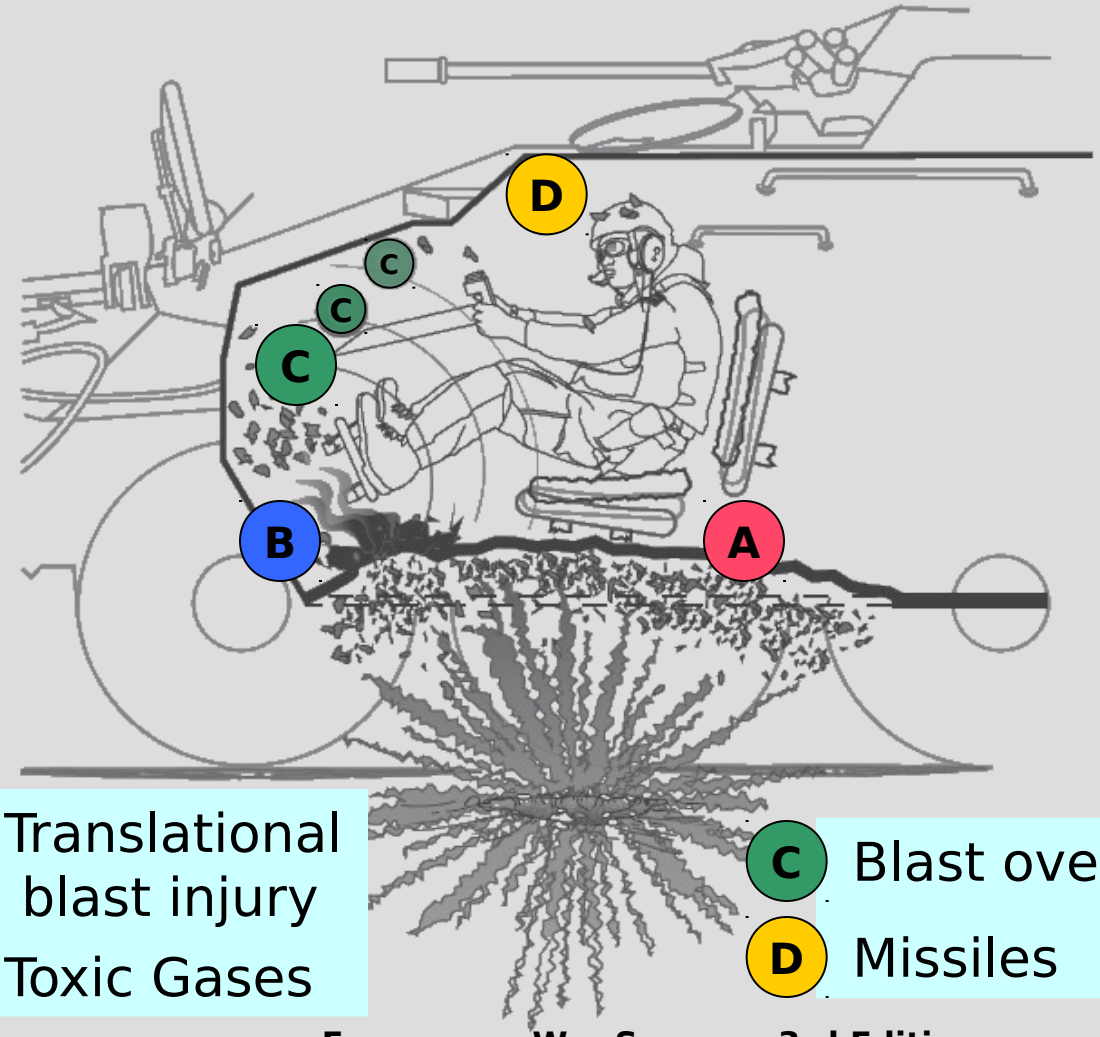
Iraq

Courtesy COL David Burris, USUHS

Homicide Bomber Casualties

- < 1 m = vaporized
- < 3 m + missing body part = dead
- > 3 meters = bizarre fragments
  - No innocent puncture wound
  - Nails, screws, and nuts
  - Human remains fragments
  - Radiographic survey helpful

Armored Vehicles



A Translational blast injury

B Toxic Gases

C Blast overpressure

D Missiles

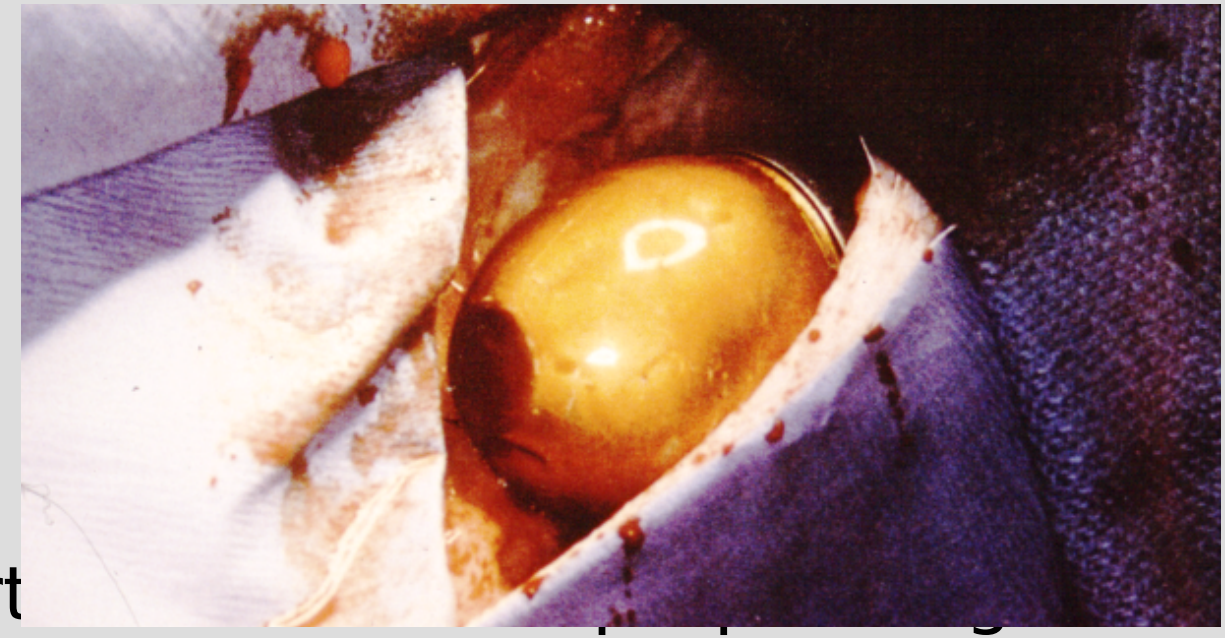
Emergency War Surgery, 3rd Edition

Toxic Gases

- Phosgene-like combustion
- Significant pulmonary toxicity
- Triage considerations
  - Emergent if pulmonary edema
  - Delayed for serial exams q2h x 24h
  - Expectant if hypotensive and cyanotic
- Treatment
  - Pulmonary support (intubation)
  - 1g methylprednisolone

Unexploded Ordnance (UXO)

- Embedded in casualty without exploding



- Mort es
- Unarmed: warhead rotates 10-12 times to activate fuse

UXO Management

- Unit safety is paramount
- Delayed triage category at all levels
- Anesthesia
  - Local/regional preferred
  - Avoid oxygen
- One surgeon operates
  - Wide debridement, no bovie
  - Do not rotate the munition

Wounds and Radiological Agents

- Protect unit & personnel
- Decontaminate open wounds first
- Triage: based on conventional injuries and modified by radiation injury level
- Debride: open wounds exposed to ionizing radiation & close at a second-look operation within 36-48 hours
- If unable to close within 36-48 hours of radiation exposure or delay until two months after injury

Wounds and Biological Agents

- Protect unit & personnel
- Decontamination of patients requiring urgent surgery:
  - Wash with 0.5% hypochlorite solution
    - » 1 part household bleach mixed + 9 parts water
  - Biologic agents neutralized within 5 min
  - Do not use hypochlorite in the eyes, body cavities, or on nerve tissue
  - Soap & water as alternative

Wounds and Chemical Agents

- Protect unit & personnel
- Precautions
  - Thin, butyl rubber gloves or double latex surgical gloves
  - Contaminated instruments and linen
    - 5% hypochlorite for 10 minutes
  - Wound excision & debridement
    - No-touch technique
    - Place specimens in 5% hypochlorite solution
    - Wipe superficial wounds with 0.5% hypochlorite then irrigate with normal saline

War Wounds

Questions?

Summary

- Epidemiology
- Goals of Combat Medicine
- Battlefield Mechanisims Injuries
  - Missile, Ballistic, Blast, Mines, Armoured Vehicles, UXO
- Surgical CBRNE concerns